Art. III.—*The Relations of the Granitic and Lower Palaeozoic Rocks near Dandenong.*

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(Communicated by Professor J. W. Gregory, D.Sc., F.R.S.).

(With Plate X.).

[Read 12th May, 1904.]

I.—Object.

The granites of Victoria are of two ages; one granite is pre-silurian, and the other was intruded in the earlier part of the devonian age. Mr. A. W. Howitt writes:[1] "Thus, leaving out of the question those rocks which are clearly felsites, it becomes evident that there are in North Gippsland two distinct classes of granites. The older are truly granitic in character, and frequently hornblendic as well as micaceous; the younger approach nearer to the felsites, and, so far as I am aware, are not only poor in mica, but also quite without hornblende. The older granites may approximately be placed at the close of the silurian, and the younger granites in the earlier part of the devonian age. There seem therefore to be grounds for the statement that, so far as our present knowledge extends, the devonian granitic rocks of North Gippsland have a peculiar character wherever met with; but in this it is necessary to guard strongly against the supposition that no true granites may have been formed in that age."

In memoirs of the Geological Survey of Victoria, in an appendix to the Report on the Chiltern Goldfields, by Stanley B. Hunter, page 42, Professor Gregory writes: "Mr. Howitt long since suggested that the granitic rocks of Victoria belong to two distinct groups. Those of one group were intrusive in devonian times. The earlier group was pre-silurian. It has been the custom to regard the great majority of the Victorian granitic rocks as belonging to the devonian group."

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1 Report of Progress of the Geological Survey of Victoria, 1877. Notes on the Geology of Part of the Mitchell River Division of the Mining District of Gippsland, p. 121.

The age of the granite at Walhalla has an important bearing on the geology of the goldfield of that district, but no fully satisfactory evidence of its age has hitherto been got near there. The granite is marked on the Geological Sketch Map of Victoria as extending almost continuously from Dandenong to Mount Baw Baw and Walhalla, and therefore its age at these three places is probably the same.

As the two groups of granites are not distinguished in the geological maps of Victoria, at the suggestion of Professor Gregory, I have examined the granite near Dandenong to try to determine its age relative to the lower palaeozoic beds.[1]

II.—Topography.

Dandenong is eighteen miles south-east of Melbourne, on the creek of the same name, which flows from the swampy land to the north-east of the Dandenong ranges. The township is about 69 feet above sea level, on slightly undulating country, to the north-east of which rise the "Dandenong Ranges"; but as these hills are isolated or connected by very low saddles, a better name would be the Dandenong Hills. Near Dandenong there are three types of rocks:—

1. Granite, forming the picturesque foot hills of the proposed National Park, in the old Police Paddocks, and the hills to the east and north-east.
2. Dacites, similar to those of Mount Dandenong, occurring near Ferntree Gully.
3. Lower palaeozoic rocks, on the flanks of the granite, and forming the low, undulating country towards Oakleigh.

III.—Literature.

There is not much literature on the geology of Dandenong district.

The earliest is a report by the late A. R. C. Selwyn on a geological map of the country between Port Phillip Bay and

1 In the absence of fossil evidence there is no certainty whether the rocks be ordovician or silurian, but the discovery, by Mr. Ferguson, of ordovician fossils in the Mornington peninsula suggests the possibility that the lower palaeozoic rocks in contact with the granites at Dandenong are also ordovician. In that case the Dandenong-Baw Baw massif may be pre-silurian though post-ordovician.

Westernport.[1] The Dandenong Creek forms part of the eastern boundary of Selwyn's map, and as all the granite, except one very small outcrop, is on the east side of the creek, the only mention of the Dandenong plutonic rocks is: "These two rocks" (feldspar-porphyry and syenite) "occur as narrow dykes cutting through and upheaving the older palaeozoic rocks, the former being on the south banks of the Yarra, and to the north of Melbourne, and the latter near Dandenong." The land to the south of Dandenong is described in the map as palaeozoic sandstones, shales, clay-slates, etc. A dyke of "sienite" is shown crossing the Dandenong creek, near Dandenong township.

In the Report of the Geological Surveyor on the Geological Structure of Victoria, 1855-56, Sec. 3, page 17, Selwyn, in his description of the plutonic rocks south of the Yarra and east of the Dandenong Creek, writes: "They have upheaved and metamorphosed the palaeozoic strata on their flanks, and have therefore been intruded since the deposition of the latter. Whether the granite and porphyries are of different periods, or only accidental modifications in mineral character of the same mass is uncertain. They often appear to pass into each other, but small isolated patches of the porphyry, as well as branches from the mass, are found penetrating the granite, which is not found similarly intruding in the porphyry; and we might therefore imagine the porphyry to have been erupted at a period subsequent to the formation of the granite. "The granite near Dandenong is not described particularly in "Geology and Physical Geography of Victoria," by Reginald A. F. Murray. On page 27 he writes: "Among the areas represented as 'trap' on the Geological Sketch Map, the rocks in three, namely, those of Mount Macedon, the Dandenong Ranges and Mount Juliet, besides others of minor extent, appear to be intimately associated with the ordinary granites, though the true relations of the rocks have not yet been properly investigated." On page 28, Mr. Murray mentions that specimens of "ternary granite" and "syenitic prophyry" from near Dandenong, and of "micaceous felspar trap," "felspar porphyry," and "syenitic felspar porphyry" from the Dandenong Ranges, are described in Mr.

1 Victoria. Votes and Proceedings, 1854-55, vol. i., pt. ii., p. 976.

Selwyn's catalogue. In a paper published in the Proceedings of the Royal Society of Victoria, vol. xiv., pt. ii., page 211, Professor Gregory writes: "Mr. Ferguson has stated that there is a gradual change from the 'granites' to the Dandenong 'traps'; but I have failed to find evidence of this, and Mr. T. S. Hart, who examined the sections on the Gembrook railway, tells me that wherever the two rocks could be seen together they were both greatly decomposed. He says there was no sign of a passage between the two rocks. This evidence is consistent with the view that the diorites and the dacites belong to different dates, and had independent origins." In a footnote Professor Gregory adds: "Since the paper was read I have examined the sections in question, and agree with Mr. Hart's conclusions." In the same paper (page 201) are given analyses of two porphyrites and a granodiorite from two miles north of Dandenong township, and a Dandenong dacite; the analyses were made by the then Government Metallurgist, Mr. H. C. Jenkins, A.R.S.M.

IV.—Geological Structure.

Near Oakleigh the lower palaeozoic rock is a soft, yellow mudstone, containing no fossils, and having a dip of about 18° W. The beds continue to the east without any change, except that of dip, as far as the Stud Road running north from Dandenong. On the west of this road the dip is constant for about three miles, and is 35° E.; it does not correspond to the surface formation, which seems to be due to erosion. About four miles north of Dandenong the Lysterfield Road, running east and west, crosses the Stud Road. On the south side of this crossing, for about a mile along the Stud Road, the lower palaeozoic rocks are exposed by road cuttings. The rock has the same appearance as that near Oakleigh, and the dip varies from 26° to 36° in directions between N. and and E.; the dip of the beds in these cuttings, and in all the other places where it can be seen, is nearly always towards the granite area and never away from it. The dip is very variable, and about a mile south of the Lysterfield Road there are some faults exposed by a shallow road cutting. On the east side of the Stud Road, on the Lysterfield Road, are a few cuttings showing lower palaeo-

zoic rock. Near the Stud Road the rock is very much broken, and the bedding is indistinguishable, but the rock is not otherwise altered. The next cutting is about two miles to the east of the Stud Road, where the Lysterfield Road crosses the foot of a hill; the rock shown has lost all sign of stratification, is harder than the unaltered rock, and is coloured red with iron. At the summit of the hill small pieces of indurated rock are scattered about, some of them showing traces of stratification. A series of hills of similar formation lies to the south-west of this hill, towards the Lower Reservoir. In a quarry for road-making, near the foot of one of the hills, the altered rock is very hard, and has no apparent stratification. In one part of the face of the quarry there is some very decomposed rock, containing a good deal of mica; it underlies the altered rock, and may be a granitic dyke. The surface of some of the altered rock is encrusted with secondary mica.

To the east and south-east of these hills there is a great number of smaller hills showing granite bosses near their summits, but I could find no other rock except at two places; the first is about half-a-mile south of the Lysterfield Road, and is marked (12) on the sketch map. At this point, near the foot of a hill, there is an outcrop of intensely altered stratified rock, containing white mica, and bedded vertically; it has a strike N.N.E., or at right angles to the slope of the hill. The outcrop of granite begins about ten yards higher up the hill, but the actual contact is hidden by soil. The second place where other rock besides granite is exposed is marked (11) on the sketch map. A hill, showing large outcrops of granite, is crossed by a dyke about six feet wide, and exposed for about 100 yards; the granite can be seen on both sides, but the line of contact is hidden by soil. In structure the dyke rock is much finer grained than the granite, and was therefore probably formed under a smaller pressure and later than the granite. Further south, on Bald Hill, loose pieces of rock, similar in appearance to that in the dyke, are found above the granite in a cutting, but no dyke can be seen.

V.—Conclusions.

As the granite is approached, the alteration in the ordovician or silurian rocks is so marked that there can be no doubt that the granite is post-ordovician. Most of the stratified rock near Dandenong is hidden by a thick layer of loam and clay, so that the bedding can only be seen in a few road-cuttings and quarries. As stated above, the lower palaeozoic beds wherever exposed are found in almost all cases to dip away from the granite area. This formation seems to be common in Victoria, and Mr. R. A. F. Murray in his Geology and Physical Geography of Victoria, page 24, writes: "Another marked feature is that the granite intrusions do not appear to be connected with the folding process to which the silurian rocks have been subjected, and to which is due the normal high rate of inclination of their layers. That process would appear to have taken place prior to the invasion of the sedimentary strata by igneous masses, as we find in many cases that the strike of silurian strata abuts directly on the granite, and in others that the dip of the strata is against, instead of with, the surface slope of the granite. Evidences of the intrusive character of the granite to a certain extent are, however, visible in many places, in the locally contorted and crumpled state of the silurian strata, near their contact with the former."

Mr. Murray then goes on to infer, from the description given by A. R. C. Selwyn, of the country east of the Snowy River, that much of the granite there was formed by the fusion and recrystallization of the silurian rocks. The granite near Dandenong does not seem to have been formed in this way as there is no intermediate rock between the granite and altered stratified rock.

There is no evidence to show that the dacite further north, near Ferntree Gully, is contemporaneous with the granite. Since dykes have been found connected with the granite, but none with the dacite, the latter is probably the younger. Therefore the granite was formed after the ordovician period, but before the dacite.

Appendix.

Note on the Microscopic Structure of Some Rocks from Dandenong,

By PROFESSOR J. W. GREGORY, D.Sc., F.R.S.

In connection with Mr. Sutherland's paper on the lower palaeozoic and granite rocks of Dandenong, I have given a few of the rocks a microscopic examination. One of the lower palaeozoic rocks from allotment 61, Narre Warren, collected by the contact, proves, on microscopic examination, to have been altered into a very fine grained biotite hornstone; it closely resembles some of the ordinary typical rocks formed by contact metamorphism around our granitic masses. The ordinary granitic rock of the district is connected with a series of dykes, the examination of which was of interest, owing to the possibility of some of them having been connected with the Dandenong dacites. The dykes examined, however, have no connection with that series, and may be all derived from the much older grano-diorite massif.

The dykes, of which the best occur in the Police Paddock and some adjacent allotments, belong to two groups. The first is a diorite-porphyry (No. 11), which is composed of phenocrysts of pale, partially leached, hornblende, and of andesine in a coarsely granular holocrystalline base. The second series of dykes is better described as quartz-biotite-porphyrite. Biotite is abundant, but has now been mainly altered into chlorite, the larger crystals containing granules of epidote, surrounded by the green chlorite. There are abundant corroded and embayed phenocrysts of quartz, and also of plagioclase. These phenocrysts are widely scattered in a very fine-grained felsitic base, which was, no doubt, originally glassy. In some cases the felspars have undergone considerable decomposition, and the dull, dusty crystals, under polarised light, are lightened up by the bright granules of zoisite.

The following analyses of these rocks may be conveniently repeated[1]:—

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1 Gregory, J. W.: The Geology of Mount Macedon Victoria. Proc. Roy. Soc. Vict., vol. xiv., n.s., 1902, p. 201.


ALLUVIUM
SILURIAN
ALTERED SILURIAN
GRANITE.
POLICE RESERVE
DANDENONG